WATER CONSERVATION NEWS

"Building sustainability, reliability, and accountability through efficient water use"

In this issue...

Water Conservation News to Publish Semi-Annually

Due to on-going budget reductions Water Conservation News will now be published semi-annually instead of quarterly. Beginning with this issue, the Spring/Summer 2004 issue, WCN will be published in July and January (Fall/Winter issue) of each year. We will continue to mail copies of the newsletter to those on the mailing list, but we also encourage readers to look for the newsletter on our Web site: www.owue.water.ca.gov.

Urban Water Savings Identified

Commercial, Industrial and Institutional Water Use Survey Program in Santa Clara County

By Karen Morvay, Santa Clara Valley Water District

In 2002, the Santa Clara Valley Water District received funding from the California Department of Water Resources (DWR) to conduct Commercial, Industrial and Institutional water use surveys within the SCVWD service area (Santa Clara County). In 2003, SCVWD awarded a contract to Pollution Prevention International, Inc. to conduct these indoor water use surveys. The goal of the surveys was to assist companies in determining if any water use efficiency opportunities exist at their facility, and, if so, determine if those needs could be met by any of the existing water use efficiency programs at SCVWD. The survey program could also be helpful in identifying gaps in the current programs and areas that need to be changed (such as placing more emphasis on cooling tower retrofits and less on other types of technology).

Twenty-six sites were surveyed from July 2003 to February 2004, including ten commercial facilities (laundromats, grocery stores, hotels, health clubs), twelve industrial sites (electronics, disk and semiconductor manufacturers, food processing, paperboard and metal finishing), and four institutional locations (a hospital and three parks). The survey process included an interview with the facility contact, a site walk, and collection of water usage data and any additional information necessary to complete the survey reports. All areas of indoor water usage were reviewed and included in the site report, including water usage for the production process, auxiliary operations and the sanitary facilities.

For all the sites as a whole, a total potential annual water savings of over 306 million gallons was identified. On average, the potential annual water savings per facility was found to be over 46 million gallons. The water savings varied significantly by sector, as well as by technology. The program identified the largest potential water savings through water and wastewater recycling systems. The water recovery and recycling technologies could generate a significant water savings, with the payback period for these systems averaging less than two years (which could be reduced even further if the business qualifies for SCVWD's Water Efficient Technology Rebate Program).

Fixture replacement and conservation devices such as ultra-low-flush toilets and conductivity controllers for cooling towers represent a smaller savings per device than the previously mentioned water and wastewater recycling systems, although there is opportunity for a greater number of these types of water savings devices to be installed throughout the county.

The estimated cost savings, project costs and payback period for each recommendation was assessed to determine the most cost effective water conservation measures in the CII sectors. Although there were water reduction opportunities present in all three sectors, the potential water savings in the industrial sites surveyed were the most cost

Continued. See "Savings" on page 3

Water Conservation News provides information on water use efficiency developments. This free newsletter is published quarterly by the California Department of Water Resources, Office of Water Use Efficiency.

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DWR does not endorse any of the businesses or consulting firms mentioned in this newsletter, since there may be others that offer the same or similar services

Bye Bye...

By Marsha Prillwitz

On May 1, 2004, I began my retirement, having served 25 years as a state employee.

As Chief of the California Department of Water Resources' Office of Water Use Efficiency, I was responsible for planning, organizing, and directing the activities of OWUE to foster improved water use efficiency and increased use of water recycling and desalination in California. During the past 20 years, my professional career has focused on the promotion of these sustainable resource management practices statewide, nationally, and internationally in Brazil, Argentina, Uruguay, Mexico, Canada, South Africa, Italy, France and Spain.

Over the years, I have been fortunate to work with very talented, dedicated, and enlightening people. I have worked with scientists and surfers, engineers and economists, accountants and academics, lawyers and landscapers, plumbers and politicians, planners and programmers, artists and activists, farmers and fishers, enthusiasts and every day people. There are great thinkers and doers in the water community, and, fortunately, big dreamers too.

I have had the pleasure of working with people from around the world right in my own office, and the delight of traveling the state, country, and world, sharing ideas and participating in positive change. Every day I have had the opportunity to learn something new and to contribute toward a sustainable water future for California. My first love at DWR was water wise gardening. Subsequently, I have become particularly fond of water efficient toilets and urinals as well as recycled water's purple pipes and farmers who practice "regulated deficit irrigation."

My wish is that the quest for a water efficient California be passionately pursued by our active water conservation circle and that the circle will be expanded to involve all Californians in a bright water future where we will meet our human needs while sustaining our precious natural world.

Office of Water Use Efficiency Mission Statement

In cooperation with others, we promote the efficient and beneficial use of California's water resources to sustain our human and natural environment.

Sacramento River Basin Subbasin Level Water Measurement Study

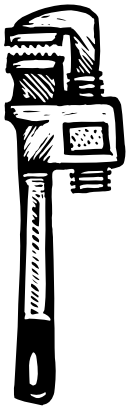
By Phil Anderson

Reclamation District 108 received a CALFED Water Use Efficiency Grant to do a feasibility study, beginning in the summer of 2001, that would investigate potential measurement locations, facilities, and associated implementation issues, in four Sacramento Valley subbasins as addressed in the Sacramento River Basin-wide Water Management Plan. Reclamation District 108 received the WUE grant on behalf of Sacramento River Settlement Contractors participating in the BWMP to study the Colusa, American, Butte and Sutter subbasins. The Redding Subbasin was also included in the BWMP, but was not included in the study due to limited grant funding and because the subbasins' crop types, irrigation methods, water quality, and adequate supplies do not generate drain-water and reuse typical of the other subbasins.

The Measurement Study objectives are:

1. Investigate and document the existing subbasin-level outflow water measurement facilities;
2. Evaluate and recommend facility improvements to achieve higher levels of accuracy or data collection if deemed appropriate;
3. Provide cost estimates for recommended measurement facility improvements;
4. Identify potential issues of implementing a regional approach to water measurement operations, data collection and use; and
5. Identify potential benefits of improved subbasin-level water measurement.

This feasibility study of these Sacramento Valley subbasins recommends funding approximately $275,000 to implement an initial two-year phase of the measurement program. These funds would be used to purchase and install equipment where needed and calibrate new and existing measuring devices to improve or ensure the accuracy of outflow measurement. At this time, the primary implementation issues related to facility installation are funding and participant agreement (as to which facilities should be installed first). Implementing the program will assist in evaluating water use efficiency at the subbasin level and will contribute to quantifiable improvements in water management by studying the feasibility of more accurate water measurement at the subbasin level. The current measurement locations in the Sacramento River Basin included in the initial implementation phase are:



- Knights Landing Outfall Gates in the Colusa Subbasin
- Reclamation District 1000 pumping plant discharge in the Natomas area of the American Subbasin
- Reclamation District 1004 discharge locations at Five Points and Putnam Mound in the Butte Subbasin, and
- Karnak Pumping plant discharge in the Sutter Subbasin.

The benefits of improved water measurement for these four Sacramento Valley subbasins are an increased coordination among BWMP participants and other entities, an improved understanding of local water balance and additional data available for water resource management.

For additional information contact Phil Anderson at (916) 651-9663 or e-mail phillipa@water.ca.gov.

Savings

(continued from page 1)

effective measure and produced the greatest water savings. Approximately 133.2 gallons can be conserved, on average, for every dollar invested into water reduction measures in the industrial sector. Although the projects are cost effective, most require a large capital investment in order to generate water and cost savings.

Approximately 89.5 gallons of water savings per dollar invested into the institutional sector could be achieved based on the survey results, and an average of 46 gallons would be reduced for every dollar invested into commercial water conservation projects. Furthermore, most of these projects required a lower initial capital investment compared to the industrial site projects. Incentive programs are valuable resources for assisting facilities in implementing water-conserving measures. Rebates and equipment replacement programs decrease the payback period, making it financially beneficial for facilities to install water reduction equipment and technology. On average, every water reduction project identified in this program had a payback period of less than one year with rebate assistance.

The survey and the reporting portion of this program are now both complete. The next step, then, will be to contact the companies to assist with water conservation project implementation and reiterate the availability of rebates. Also, SCVWD now has a better idea of which CII areas to target and how to fine-tune the rebate program. Furthermore, SCVWD plans to administer another CII water use survey program in the next year.

California Water Conservation Case Studies:

Summary

Between 2000 and 2030, California's population is expected to grow by 17 million people, a 50 percent increase in population. This growth--combined with reduced surface water supplies, an unsustainable overdraft of the state's groundwater and environmental water requirements--is making the challenges to meet California's water needs greater than ever. Water conservation, water recycling and desalination have been identified as major strategies to meet the demand. Significant investments are necessary to support these actions. In 2001, the State invested $12 million to co-fund 46 agricultural and urban water conservation projects. The California Department of Water Resources, the lead state agency for this project, issued the Project Solicitation Package (PSP) on January 2, 2001. Summaries of selected projects follow:

Project Number 1: Technical Assistance Program for Irrigation Districts

California Polytechnic State University, Irrigation Training and Research Center (ITRC)

The goal of this project was to provide technical assistance to water users and identify new opportunities for water conservation and improved water management for irrigation districts. This program targeted water district personnel, farmers, individuals and organizations such as irrigation supply dealerships.

The first component was a variety of programs aimed at all agricultural water users. ITRC and irrigation districts held training classes in:

- water delivery modernization,
- basic principles for ditch riders and water masters,
- flow measurement,
- on-farm irrigation system design, and
- on-farm irrigation system management.

Water users were able to participate in these classes as well as a variety of other seminars and workshops. In-house specialty training for U. S. Bureau of Reclamation, DWR, the Agricultural Water Management Council and other agency personnel was also provided.

Training was not the only technical assistance provided during this project. Special studies were also conducted for purposes such as identifying water conservation potentials, or understanding cause, effect and solutions for technical problems. Newsletter articles and reports were created to explain study results and demonstrate new technologies directed at informing and educating irrigation professionals.

The second component was aimed at individual irrigation districts. The ITRC provided technical expertise for specific water conservation programs for five individual districts, at their request. This included:

1. Reviewing modernization and water management plans
2. Using the Rapid Appraisal Process to identify modernization needs
3. Developing guidelines and assistance with quality control for districts that may be interested in setting up on-farm irrigation evaluation and scheduling programs
4. Reviewing plans or guidelines prepared by consulting engineers for irrigation district modernization or water management programs
5. Assisting with the implementation of the Supervisory Control and Data Acquisition
6. Assisting with implementation of flow measurement programs including 20 flume designs
7. Assisting with other modernization efforts, such as improving pumping plant operations, water ordering and pressure control for improved water and energy management.

Project Number 2: Measurement of Non-point Source Pollution Reduction in Vineyards with Improved Irrigation Efficiency

Lodi-Woodbridge Winegrape Commission

Conventional farming of wine grapes can adversely impact the environment, water supply and quality. To address these problems the Lodi-Woodbridge Winegrape Commission has, over the past eight years, developed a sustainable farming program for wine grapes that focuses on NPS pollution reduction and water use efficiency. The commission developed a project with four objectives.

- The first objective was to engage all 650 LWWC growers in implementing sustainable farming practices in their vineyards. Thirty workshops reached 200 growers, farming 55 percent of vineyard acres and 49 plans entered in the LWWC database. The workshops assisted farmers in completing the Lodi Winegrower's Workbook self-assessment program.

- The second objective was to document and track the level of adoption of sustainable farming practices in LWWC using LWWC's database system and survey tools and to measure the impact of the program on reduction of NPS pollutants and increased water use efficiency. Two hundred self-assessment vineyard evaluations were entered into database. Inputs for 60 vineyards were then tracked and entered into the database.
- The third objective set up an opportunity for staff to present the self-assessment workbook program

Paving the Way for a Water Efficient State

as a model pollution prevention and increased water use efficiency program to other commodities in the Central Valley. Twenty presentations on the project were made to vineyard grower groups.

- Finally, through the fourth objective, staff was to report on project results. This also included revising the text of the Lodi Winegrower's Workbook based on project experience and sharing lessons learned from the project with all participating or funding groups.

Project Number 3: Assessing Spatial and Temporal Variability of Soil Salinity on Farms

Implementing Integrated Drainage Management Practices
Center for Irrigation Technology, California State University, Fresno

Many farmlands on the west side of the San Joaquin Valley are threatened by high salinity and poor drainage. The threats affect crop yields and soil quality. The need to reduce salt build-up in soils and improve efficiency of irrigation has led to a collaborative effort between DWR, Westside Resource Conservation District, and Westlands Water District, which called for integrated on-farm drainage management (IFDM) practices. Such practices are expected to conserve irrigation water by reducing drainage water outflow on farms. This research proposed to use electromagnetic (EM) induction surveys and geo-statistical analyses as reconnaissance tools to assess spatial and temporal variability of soil salinity following implementation of IFDM practices at several farms. The project was conducted over three years and evaluated the effectiveness of IFDM on reducing soil salinity and improving efficiency of water use.

Four farms participated in the IFDM program. Soil salinity surveys, geo-referencing, and geo-statistical analyses were conducted over three years. Initial EM measurements were started in October 2001 on all farms enrolled in the IFDM program. Two other EM measurements were taken during on-going IFDM in fall 2002 and 2003 to monitor salinity response to the new practice. Following each EM survey, the project produced salinity maps, and conducted geo-referencing and geo-statistical analyses. Before and after IFDM salinity levels (variability, distribution) were compared, analyzed, and used for crop rotation and drainage management recommendations to growers.

Project Number 4: Evaluation of Salt-Tolerant Floral and Forage Crops as a Strategy for Conserving Fresh Water Resources

United States Department of Agriculture, Agricultural Research Service experiments were conducted at the U.S. Department of Agriculture Agricultural Research Service George E. Brown Jr. Salinity Laboratory in Riverside using greenhouse and outdoor sand tank lysimeter systems. Dry matter production rates of the forages and the water balance of the sand tanks were measured periodically. Electrical conductivity (EC) was monitored as was pH to document actual salinity and alkalinity of the irrigation solutions. The forage tissue was dried, ground, and analyzed for major inorganic salts (Sodium, Calcium, Magnesium, Potassium, Chlorine, Phosphorous and Sulfur) and forage quality.

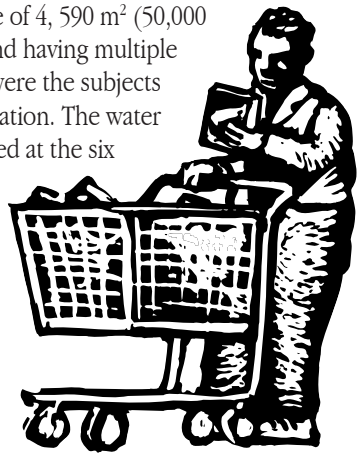
Water use efficiency was calculated based on accumulated biomass or economic product for each salinity treatment. Additional salinity-stress and stress relief experiments were conducted for flower crops in a greenhouse sand-tank facility to quantify the number of suitable flowers that could be salable. Floral crops were assessed based on commercially acceptable criteria for flowers, and biomass production was also measured as an indicator of plant performance under the range of saline treatments.

Project Number 5: Water Conservation in Urban Supermarkets

Aquacraft

The goal of this project was to quantify the water-saving potential and the economic feasibility of using advanced water treatment in grocery store cooling systems, and to look for water savings in the other uses at the stores.

Six full-service urban supermarkets with an average size of 4, 590 m^2 (50,000 square feet) and having multiple departments were the subjects of this investigation. The water savings achieved at the six sites exceeded the amounts predicted by the theoretical calculations. On average, the shift from conventional to advanced treatment resulted in savings of 2,684 m^3 (709,000 gallons) per year.



A benefit/cost analysis showed that advanced water treatment program can pay for itself in one or two years, and that over the life of a new evaporative condenser, the benefits from using advanced water treatment will be between 2 and 10 times the incremental costs of using the system. Recommendations for other in-store water savings included the use of high-efficiency spray nozzles, aerators, and water flow restrictors on all hand sinks and spray tables, elimination of garbage grinders in favor of composting produce wastes, replacement of low pressure hoses with high-pressure sprayers for washing meat, and encouraging leak reporting and water conserving ideas by employees.

Continued. See "Studies" on page 6

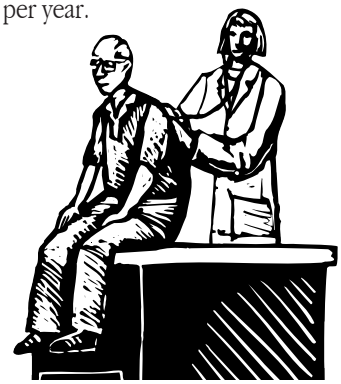
Studies

(continued from page 6)

Project Number 6: Joint Agency X-Ray Processor Retrofit Program for Hospitals

Irvine Ranch Water District

Hospital x-ray processors operate constantly and consume from 0.2 to 2.5 gallons of water per minute (gpm). There are very few 0.2 gpm models (105,000 gallons per year) in service and most operate near 2.5 gpm (1,314,000 gallons per year). New water re-circulation technology is available. It reduces consumption to about 13,000-24,000 gallons per year.



There was an average savings of 98 percent over seven installations, saving 30,000 m^3 (24.24 acre-feet) annually. The project cost per acre-foot saved was $139 ($69 for a 20-year life) and an equipment-only cost per acre-foot saved was $103 ($51 for a 20-year life).

Project Number 7: Regional High Efficiency Washing Machine Rebate Program

Electric and Gas Industry Association

High efficiency clothes washers use 60 percent less energy and 40 percent less water per load than conventional machines. Through an SB 23 funded rebate program seven Bay Area water agencies issued more than 27,000 high efficiency clothes-washers rebates. Water agency funds matched the $1,785,000 grant on a dollar-for-dollar basis, plus contributed $780,000 in program administration services.

The program provided retailers with lists of products that qualified for the rebate.

Retailers said the program helped increase sales. Retailers were kept apprised of all program conditions and changes. The final report includes a spreadsheet that identifies the 107 washing machine models that were rebated. The spreadsheet also includes quantities rebated, water factor and tier.

Project Number 8: Weather-based Controller Retrofit Program for Urban Landscapes

Santa Barbara County Water Agency

Coordinated by the Santa Barbara County Water Agency, this project included the cities of Santa Barbara, Lompoc and Santa Maria, the Goleta Water District and the Vandenberg Village Community Services District. The goal of the project was to distribute 300 ET controllers with rain sensors and soil probes at no cost, other than the monthly $4 data link charge that provides CIMIS weather data. The WeatherTRAK ET controller was chosen by the Irvine Ranch Water District.

Early installations showed that some water bills increased after installation of the ET controllers. An investigation showed that turf was being over-watered and drip lines were being under-watered. The team concluded that the factory-set default precipitation rates of some irrigation systems were far too high. These were adjusted. The 12-station limit of the controllers also limited their effectiveness in some larger landscapes. Post-installation adjustments by the consumer were unreliable.

62 installations have been completed so far. The project has been extended for another year and expects to complete the remaining installations. Although the data are early and not statistically significant, there was an average of 26 percent water savings, ranging from 59 percent to 8 percent savings.

Project Number 9: Waste Not, Want Not - The Potential for Urban Water Conservation

Pacific Institute

The purpose of this study was to investigate potential water savings in the urban sector as well as the costs associated with those efforts. The Pacific Institute estimated that 2,836 million m^3 (2.3 million acre-feet) of water, one-third of California's current urban water use, could be saved with existing technology. Eighty-seven percent or two million acre-feet of that savings could be accomplished cost effectively. The study looked at indoor domestic water use, outdoor residential water use, as well as commercial, industrial and institutional water use.

Water Conservation Events

Pacific Horticulture Symposium: Gardening Under Mediterranean Skies IV: Exploring California Style

October 1 to 3, 2004
Los Angeles County Arboretum and Botanical Garden, Arcadia
October 8 to 10, 2004
Strybing Arboretum and Botanical Garden, San Francisco

Speakers and Workshops will offer in-depth presentations on creating and maintaining gardens appropriate to California's Mediterranean climate. Workshop topics include plants, container gardening, firescaping, edibles, and wildlife. For more information visit www.pacifichorticulture.org/medskies, e-mail medskies@pacifichorticulture.org or call (866) 633-7543.

Remote Sensing for Evapotranspiration

By Mark Roberson, California Bay-Delta Authority

Evapotranspiration (ET) is the key to understanding where and when water is depleted. Native vegetation, rain-fed agriculture, irrigated agriculture, urban landscape and wetlands all consume water through evapotranspiration. The traditional approach of estimating an area's crop water use ET is using land use surveys to define the areas occupied by different types of crops, native vegetation, wetlands and urban uses and by multiplying reference ET (ETo - computed from CIMIS weather data for California) by crop- and landscape- coefficients (Kc and KL) developed through research on small scale plots under controlled conditions or by estimation based upon water use data analysis. Land-use surveys are labor intensive and costly and the ET estimates derived can be subject to uncertainties due to differences between controlled conditions and actual conditions.

Remote sensing ET estimates, on the other hand, use digital satellite imagery combined with processing algorithms that solve the surface energy balance. Processing algorithms that solve the surface energy balance have been validated against several alternative ET estimation methods on scales ranging from field to basin and across a wide range of climatic conditions in several countries. In just one of these validations, excellent seasonal agreement was obtained between remotely sensed ET and lysimeter measurements in Idaho.

Processing algorithms use spectral radiances recorded by satellite-based sensors plus weather data from ground-based stations, such as CIMIS, to solve the energy balance at the earth's surface. Primary outputs are the actual evapotranspiration (ETact), and biomass production of agricultural crops and native vegetation. Radioactive, aerodynamic, and energy balance equations are applied to

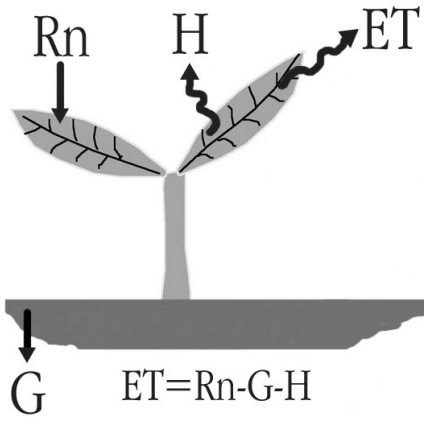


Figure 1: Schematic of energy balance. Symbols are net radiation (Rn), heat flux to air (H), heat flux to ground (G) and the residual or ET

calculate the residual energy. Residual energy converts liquid water-to-water vapor or ET which is technically referred to as latent heat flux as shown in Figure 1. Processing algorithms use input from any satellite measuring the required spectral radiance bands. LANDSAT and MODIS are two satellites that produce images often used as input.

The output of the processing algorithms is a composite ET rate for each pixel at the instant of the satellite image. This instantaneous ET rate can be extrapolated to obtain daily, weekly, monthly and seasonal values from ground-based weather stations and additional satellite images. The more frequently the images are processed, the more accurate the ET estimation. Because the output is a composite value, it may represent more than one land use type, so to get a single land use type within a pixel requires knowledge of the types of vegetation within the pixel; typically this is handled with a geographic information system application coupled with ground-based verification.

The two primary uses of ET information are water management planning and irrigation scheduling. ET can be calculated from crop coefficients and ETo or from remote sensing computations. ET can also assist in irrigation evaluation and management by identifying areas of lower ET within a field. In Figure 2, the output shows the distribution of actual ET rates for pasture, cherries and wine grapes on July 25, 2000, and the daily reference ET, determined by Public Agricultural Weather Systems at Washington State University. The distribution of ET is a function of the plant type and soil water potential that is affected by soil water content and soil salinity.

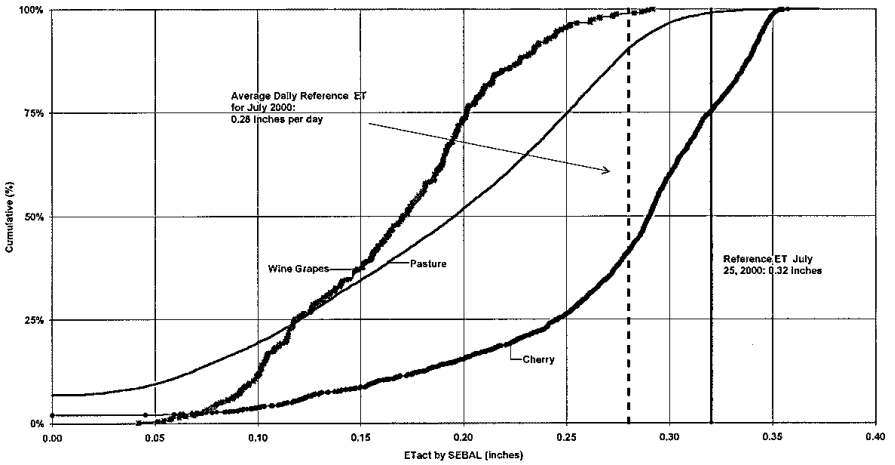
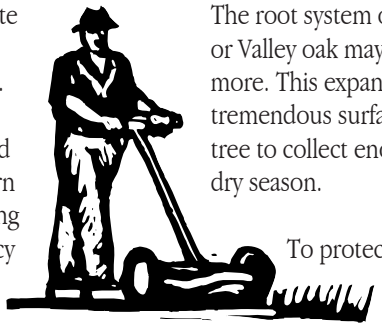


Figure 2. Distribution of ET for cherries, pasture and winegrapes on July 25, 2000. Average daily ET during the month of July was 0.28 inches per day, ET on July 25 was 0.32 inches.

Preserving Trees after Landscape Conversions

By Julie Saare-Edmonds

Landscape conversion is becoming more popular for water conservation. Usually by offering rebates, several water agencies throughout the west encourage the conversion of high water using, predominately turf landscapes, to a type of landscape that requires far less water. These landscapes require much less maintenance and generate far less green waste than a typical mostly-turf yard. Usually the homeowners enroll in the program and attend workshops to learn basic water wise gardening principles or water agency staff may conduct site visits. Inspections after installation are usually required before the rebate is issued. These programs have a great potential for saving water. Southern Nevada Water Authority has been offering turf conversion rebates since 1999. SNWA has had great success with the program by converting over 18 million square feet of grass on more than 7,500 properties. The water savings are at least 1.4 billion gallons per year.



When removing large areas of grass where trees are present there are some things to consider such as tree rooting pattern, weather, techniques for removing turf, soil preparation and irrigation after conversion. Water agencies interested in starting a landscape conversion program need to consider these factors and communicate them to customers who are interested converting their landscape.

Contrary to popular belief, most mature trees do not have deep tap roots. Most of the root system is horizontal and near the surface. The large woody roots function primarily as structural supports for the tree. The tiny feeder roots that are found within the top few inches of soil are the major suppliers of water, nutrients and oxygen to the tree. These roots are often intermingled with the grass roots and can be damaged when the turf is removed. Roots of many trees extend well beyond the "dripline," frequently two to three times the width of the canopy. Extensive roots systems are part of how California's oaks survive the long summer dry period. The root system of a 30-foot wide Blue or Valley oak may extend to 100 feet or more. This expansive root system has tremendous surface area that enables the tree to collect enough water to survive the dry season.

To protect the trees some careful steps must be taken. If possible the landscape conversion should be done during a cooler time of year; this will minimize stress on existing trees and will ease stress on the newly installed plants. It is important, for example, to choose a method for removing turf that will minimize disturbance to the roots. Covering the grass with mulch or landscape fabric to shade it out is one method. If shading out will take too long for the project, a sod cutter adjusted to a shallow setting can be used to preserve as many tree roots as possible. If herbicides are preferred, note precautions on the package labeling to be sure the tree will not be damaged.

After the grass is removed minimize disturbance of the soil while trenching and digging planting holes. Tractors or vehicles should never be driven over or parked on root zones. Trees may need to be watered if there is no rain during the construction phase. When the new landscape irrigation is installed, a separate zone from the zones used for shrubs and perennials needs to be designated for trees because trees will require less frequent but deeper irrigation than shrubs. Depending on the tree size and species, several emitters may be required to adequately water the root zone. After the irrigation system and plants are installed, a layer of mulch placed in the planting area can help to prevent water loss by evaporation. Mulch should be kept away from the trunk of trees and stems of shrubs--two to three inches is sufficient. If the mulch is too deep it may hold too much moisture in the soil and impede oxygen movement. After the landscape is completed, the health of the trees needs to be monitored and adjustments in the irrigation schedule made as needed. Over time the trees will re-establish in the soil and may need less frequent irrigation. If the trees show signs of stress that does not improve with irrigation, or if there is a general decline in health, consult a certified arborist.

Trees are an important part of the urban landscape because of cooling shade, the oxygen they give off, the homes and food they provide to wildlife and the esthetic value to all of us. Maturing trees represent an investment in time, water and resources that is difficult to recover. More information on trees is available from your local Urban Forestry Association or the National Arbor Day Foundation at www.arborday.org.

Recycled Water Saves Watts?

By Fawzi Karajeh and Fethi BenJemaa

Water recycling not only saves fresh potable water supplies, but also conserves energy. In California, pumping water out of natural sources, conveying it to areas of use, treating and distributing it to customers, and treating wastewater accounts for one of the state's largest energy uses. Improving the efficiency with which water is used provides an important opportunity to increase related energy efficiency.

Recycled water use has a dual benefit of adding a reliable source of water for many uses (mainly non-potable uses) and improving the state's energy use efficiency. Advancing the use of recycled water in thirsty Southern California would help greatly reduce the region's reliance on imported supplies from the north and from the Colorado River. In addition to saving conventional water supplies and contributing to the restoration of the fragile Delta ecosystem, the use of recycled water may also prove to be less energy-demanding than other alternatives. Studies have shown that pumping water to Metropolitan Southern California from the State Water Project over the Tehachapi Mountains or through the Colorado River Aqueduct requires, respectively, about 3,000 kilowatt-hours and about 2,000 kilowatt-hours per acre-foot of delivered water. These numbers are significantly higher than the supplemental energy needed (beyond discharge requirements) for water recycling, which is reported to be less than 500 kilowatt-hours per acre-foot of recycled water produced for many non-potable uses and about 1,200 kilowatt-hours for recycled water produced through membrane processes, such as reverse osmosis.

When compared to importing water from Northern California, a water recycling project the size of the Groundwater Replenishment System in Orange County (78,000 acre-feet in Phase I) is estimated to generate energy savings of about 140 million kilowatt-hours annually or enough energy to serve approximately 21,300 homes each year. So, the expansion of recycled water use will not only reduce the pressure on California's precious fresh water resources, but also help save millions of watts.

Emerging Contaminants: What's in Your Water?

By Fethi BenJemaa and Fawzi Karajeh

Emerging Contaminants, Xenobiotics, Endocrine Disruptors, Endocrine Active Chemicals, Pharmaceuticals and Personal Care Products, Hormonally Active Agents, Persistent Organic Pollutants, Bioaccumulative Chemicals of Concern...And the list goes on. These are some of the many terms that we hear and read about more and more lately; such terms are either synonymous or describe some intersecting sets of a plethora of chemicals and pollutants. They are a new class of chemical pollutants and toxins that managed to spread into the environment, making their way into streams, lakes and groundwater. Even though such pollutants have only gained attention in recent years, they most likely have been present in the environment for a long time.

The main origins of these contaminants are personal care products (fragrances, deodorants, disinfectants, cosmetics, sun screens, and insect repellants), various pharmaceutical products (prescription and over-the-counter drugs, antibiotics, and diagnostic agents), detergents, cleaning agents, household chemicals, agricultural fertilizers, pesticides, fungicides and animal growth hormones. The universal and widespread use and subsequent discharge of such products on a continuous basis further exacerbate their persistence in our waters. A monitoring study conducted by the U.S. Geological Survey during 1999 and 2000 of 139 streams in 30 states, including several in California, found small amounts of such emerging contaminants in 80 percent of surface water samples. Many of these contaminants are associated with municipal, industrial, and agricultural wastewaters. As such pollutants are easily transported into the environment through various ways, the issue of emerging contaminants is of paramount importance not only to the wastewater and water recycling community but also to the water supply, environmental ecology, and public health communities.

These emerging contaminants are of growing concern as some even at trace concentration levels, could alter the physiological responses and the endocrine and reproductive systems in humans and

Continued. See "Contaminants" on page 11

Advances in desalination technologies are helping to generate new potable water to California

Desalination on the Move in California

By Fawzi Karajeh and Fethi BenJemaa

Desalination is not a new idea. There are over 11,000 desalination plants worldwide producing about 5,400 million gallons per day of desalinated water, of which 600 mgd is being produced in North America. It is reported that desalination capacity might grow by 10 to 20 percent annually in the coming decade. California scientists, resource planners, and policy-makers continue to take a long-term view of the water resources in the state. In the upcoming California Water Plan Update, water recycling as well as seawater and brackish water desalting are expected to be prominent components.

In addition to the growing demand for water due to population increase (it is estimated that California's population will increase by 17 million by the year 2030), current conventional water sources are threatened by overdraft, depletion and pollution. Other factors contributing to the dwindling of water supplies include climatic changes, the imminent compliance with the Colorado River 4.4 plan, successive and extended periods of drought, and the growing need for environmental and ecosystem restoration. Desalination has the potential to offer an alternative supplemental reliable water supply. In addition to enhancing water quality through state-of-the-art treatment processes, the use of desalinated water would free up other water supplies contributing to ecosystem restoration, minimizing transfers from agriculture to urban users, and reducing the dependence on imported water.

The California Legislature has recognized the future importance of seawater and brackish water desalination through legislation. In 2002, the Legislature approved Assembly Bill 2717 (Robert Hertzberg) which mandated DWR to convene the California Water Desalination Task Force to look into potential opportunities and impediments for using seawater and brackish water desalination, and to identify what role, if any, the state should play in furthering the use of desalination technology. For more information about the recommendations the Task Force submitted to the Legislature in its final report visit **www.owue.water.ca.gov/recycle.**

In November 2002, California voters passed Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002. Chapter 6 of Proposition 50, entitled Contaminant and Salt Removal Technologies, allocates $50 million in grants for seawater and brackish water desalination projects under Chapter 6(a). The program, administered by DWR, provides grants for construction projects as well as research and development, feasibility studies, and pilot and demonstration projects. This program aims to assist local agencies with the development of local water supplies through brackish water and seawater desalination. For more information visit www.owue.water.ca.gov/finance/index.cfm.

And, on August 9, 2003, Governor Davis approved AB 314 (Kehoe). This bill made it a state policy that desalination projects developed by or for public water entities be given the same opportunities for state assistance and funding as other water supply and reliability projects, and that desalination be consistent with all applicable environmental protection policies in the state.

Federal legislation encouraging the development of desalination projects as a means of addressing the nation's water supply problems was introduced in the House in February 2004. The legislation, entitled the "Desalination Energy Assistance Act of 2004," would authorize the Department of Energy to make competitive grants available to make drinking water from seawater and brackish groundwater.

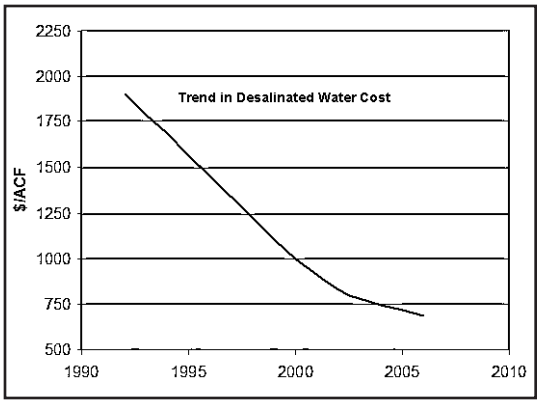


Figure 1: Trend in Desalinated Water Cost

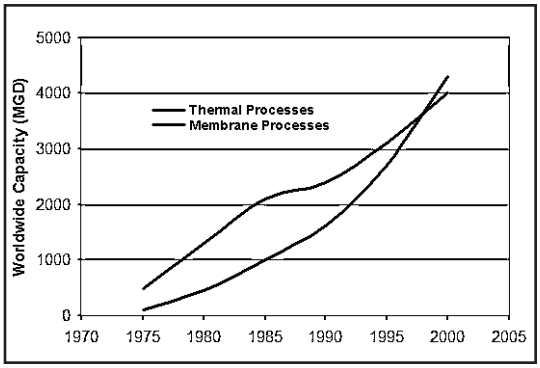


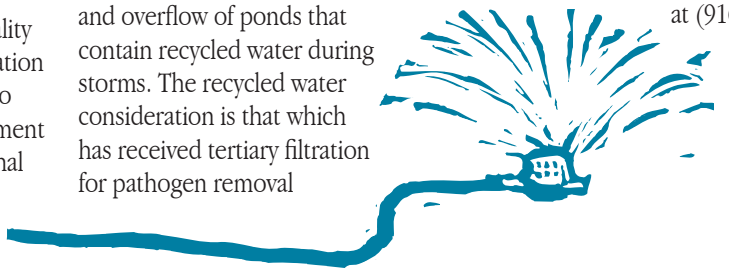
Figure 2: Global Desalination Capacity

Clarified Regulation of Incidental Runoff of Recycled Water

By Fawzi Karajeh and Nancy King

In June 2003 the California Recycled Water Task Force published a report that contained several key recommendations; one of these was Recommendation 4.2. 1. In 4.2.1 the Task Force recommended that the State Water Resources Control Board convene a committee to review the legal requirements of federal and state statutes and regulations and water quality considerations that relate to the regulation of incidental runoff of recycled water to determine the regulatory and enforcement options that are available to the Regional Water Quality Control Boards. SWRCB accepted this recommendation and on February 24, 2004, the SWRCB, committee sent a memorandum to the Regional Boards' Executive Officers that contained recommendations on how to regulate incidental, runoff of recycled water.

The memorandum, in an attempt to further the safe uses of recycled water (a legislatively established objective), defined incidental runoff as the small amounts of runoff from intended recycled water use areas, over-spray from sprinklers that drifts out of the intended use area, and overflow of ponds that contain recycled water during storms. The recycled water consideration is that which has received tertiary filtration for pathogen removal as specified under Title 22. Part of the Framework for Regulation of Incidental Runoff established by the State Board is highlighted in the side bar on page 12.



This collective effort of the State Board, Regional Boards, and stakeholders is expected to maintain the protection of public health and pave the way for increasing the use of recycled water in California within federal and State statutes and regulations. For information on the memorandum, you may contact Gordon Innes of the State Board at (916) 341-5517 or inneg@swrcb.ca.gov.

Continued. See "Regulation" on page 11

Contaminants

(continued from page 9)

animals by mimicking natural hormones. Potential adverse effects include reproductive impairment and disorders, cancer, and other unknown toxicity effects that are yet to be discovered and understood. The toxicological significance of these trace contaminants can be intensified by their additive effects (simultaneous exposure to a multitude of agents) as well as their possible interactive effects.

Even though there are currently no regulations governing the monitoring of pharmaceuticals and other emerging contaminants in water, the California Department of Health Services has already proposed draft regulation language requiring monitoring for the occurrence of nonregulated chemicals in water intended for groundwater recharge. (DHS Groundwater Recharge Reuse Regulations, July 2003 Draft, section 60320.040. Control of Nonregulated Chemicals). The unregulated chemicals that DHS requires monitoring are those that lack drinking water standards but nonetheless require analysis and are found in Title 22 of the California Code of Regulations section 64450, effective January 3, 2001. These include inorganic chemicals (Boron, Chromium-6, Perchlorate, and Vanadium) and organic chemicals (Dichlorodifluorom ethane, Ethyl tertiary butyl ether, Tertiary amyl methyl ether, Tertiary butyl alcohol, and 1,2,3-Trichloropropane).

Conventional water treatment technologies currently available may not be effective for the removal of all emerging contaminants. Advanced membrane processes such as reverse osmosis (RO) and nanofiltration (NF) offer the best available treatment alternatives. However, additional research and data are needed to determine the effectiveness of different water treatment technologies including RO and NF in removing such trace chemicals. DWR, in order to understand the fundamentals and the factors driving rejection of contaminants of concern in membrane treatment systems, is participating in a study aimed at developing a standardized bench-scale testing protocol for organic micropollutant rejection considering different water quality matrices and membrane operational conditions. The study will also evaluate the viability of NF and new low pressure RO membranes for rejecting unregulated and regulated organics as well as nitrogen under a range of experimental conditions at the bench-, pilot-, and full-scale. DWR's study partners include West Basin Municipal Water District, AWWA Research Foundation, WateReuse Foundation, Colorado School of Mines, the University of Colorado, and Koch Membrane Systems.

Additional resources and information on emerging contaminants can be found at the U.S. EPA National Exposure Research Laboratory Web site at **www.epa.gov/esd/chemistry/pharma/index.htm** and the U.S. Geological Survey Toxic Substances Hydrology Program at **http//toxics.usgs.gov/index.html**.

WATER CONSERVATION NEWS
P. O. Box 942836
Sacramento, CA 94236-0001

Address Correction Requested

Regulation *(continued from page 11)*

…To further the goal of maximizing the use of recycled water, the water quality laws should be interpreted in a manner that is consistent with the intent of the Legislature to promote recycled water use. Consequently, incidental runoff from recycled water projects should be handled as follows:

1. Where reclamation requirements prohibit the discharge of waste to waters of the State and discharges are not expected to occur, occasional runoff should not trigger the need for either an individual NPDES permit or enforcement action.
2. If discharges from a reclamation project area occur routinely, such discharges can be regulated under a municipal storm water NPDES permit in most cases.
3. In limited cases, where necessary to address a water quality concern, discharges of recycled water to surface waters may be regulated under an individual NPDES permit. An NPDES permit, however, should not be issued unless necessary to achieve water quality objectives.

Generally, parties using reclaimed water will want to operate in such a way as to avoid the need for an individual NPDES permit. The discussion below describes the framework for regulating incidental runoff from irrigation systems and from storage ponds without issuing such a permit.

Incidental Runoff Associated with Recycled Water Irrigation

Recycled water use facilities should be designed and operated to avoid runoff to waters of the State. The regional boards should work with recycled water users to help them achieve this goal. Nonetheless, incidental runoff is likely to occur at many facilities. Consequently, regional boards should include the following language in water recycling requirements.

The incidental discharge of recycled water to waters of the State is not a violation of these requirements if the incidental discharge does not unreasonably affect the beneficial uses of the water, and does not result in exceeding an applicable water quality objective in the receiving water."

The language is modeled after the language included in the Master Reclamation Requirements issued by the San Francisco Bay Regional Board.

Releases from Recycled Water Ponds

A principal water quality concern with recycled water ponds is the presence of locally added pollutants, such as fertilizers and algaecides. These same issues exist with potable water ponds.

Recycled water ponds should be designed and operated not to spill during dry months. Spills should be prohibited during these times. Generally, wet weather regulatory strategies that do not require individual NPDES permits fall within the following categories:

1. The recycled water pond is designed not to spill during wet months. Under this circumstance, spills that occur under extreme weather conditions or emergencies should not be considered for enforcement.
2. Recycled water ponds can be drained and refilled with potable water or flushed with potable water prior to the onset of the wet season. Flushing will not displace all of the recycled water but the water quality threat is minimal.
3. Recycled water ponds designed to spill recycled water during the wet season can be regulated under Phase 1 municipal storm water permits or under a general storm water permit. These permits require reduction of pollutants to the maximum extent practicable. The permits also incorporate receiving water limitations requiring the implementation of an iterative process for addressing any exceeding of water quality objectives.